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DOCUMENT 152-83

IRIG STANDARD FOR DISTRIBUTING INTERRANGE VECTOR ACQUISITION DATA

DATA REDUCTION AND COMPUTING GROUP

RANGE COMMANDERS COUNCIL

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Interrange vector acquisition data, distribution, remote tracking instruments, reference spheroid, Global Coordinate System, earth-fixed, non-inertial, geocentric, right-handed cartesian coordinate system, system axes, teletype message format.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

None

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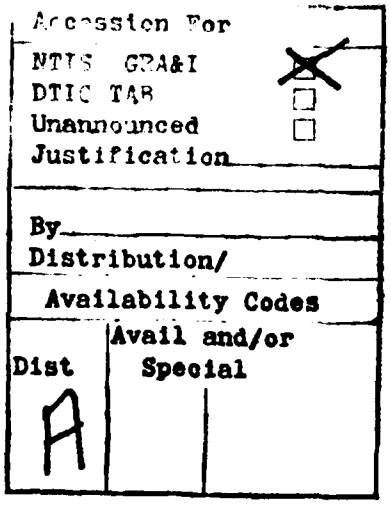
September 1983

Prepared by

Data Reduction and Computing Group
Range Commanders Council



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PURPOSE

This document defines a standard procedure for distributing interrange vector acquisition data to remote tracking instruments.

APPLICATION

The standard procedures set forth herein are recommended, where applicable, for interchange of acquisition data among the National and Service Ranges and other ranges associated with the Range Commanders Council.

LIMITATIONS

This standard does not apply to the distribution of raw radar data.

STANDARD REFERENCES AND PROCEDURES

1. The IRIG WGS-72 Convention, described in a subsequent paragraph, is used as the reference spheroid for acquisition data.

2. The Global Coordinate System. Vector acquisition data are referred to as an earth-fixed, non-inertial, geocentric, right-handed, cartesian coordinate system. Orientation of system axes is:

   a. System origin is at the geocenter.

   b. Positive E-axis extends from origin through Greenwich meridian at the equator.

   c. Positive F-axis extends from origin through 90°E meridian at the equator.

   d. Positive G-axis extends from origin through the North Pole.

3. Teletype Message Format. The IRIG Interrange Vector Teletype Format in figure 1 is used for transmitting nominal pre-launch, in-flight, no-data, and simulated acquisition messages. Full details associated with each field of the format are shown in figure 2.

FIGURE 1

IRIG INTERRANGE VECTOR TELETYPE FORMAT

IRSTAAAAA

NOOOOO MM DD PPPP B

SEEEEEEEEEE CC SFFFFFFFFFF CC SGGGGGGGGGG CC

$\dot{S}\dot{E}\dot{E}\dot{E}\dot{E}\dot{E}\dot{E}\dot{E}$ CC $\dot{S}\dot{F}\dot{F}\dot{F}\dot{F}\dot{F}\dot{F}\dot{F}$ CC $\dot{S}\dot{G}\dot{G}\dot{G}\dot{G}\dot{G}\dot{G}\dot{G}$ CC HHMMSSS CC

IRED

KEY:	IRST	= Start of message code
	A	= Range address
	N	= Data type
	O	= Operation number
	M	= Month of year, Five in first digit, if pre-launch data
	D	= Day of month, Five in first digit, if pre-launch data
	P	= Orbit number
	B	= Body number
	S	= Sign of data
	E F G $\dot{E}$ $\dot{F}$ $\dot{G}$	= Coordinate and velocity data, geocentric, meters, meters/seconds
	C	= Checksum of preceding characters
	H	= Hours, Greenwich or T-time
	M	= Minutes, Greenwich or T-time
	S	= Seconds, Greenwich or T-time
	IRED	= End of message code

FIGURE 2

DETAILS OF IRIG VECTOR TELETYPE FORMAT

Line No.	Character No.	Character	Note	Description	
				Carriage Return	(Precedes Line 1)
				Carriage Return	(Precedes Line 1)
				Line Feed	(Precedes Line 1)
				Line Feed	(Precedes Line 1)
				Letter Shift	(Precedes Line 1)
1	1	I		Always the same	
	2	R		Always the same	
	3	S		Always the same	
	4	T		Always the same	
	5	A	1	Range Address	
	6	A	1	Range Address	
	7	A	1	Range Address	
	8	A	1	Range Address	
	9	A	1	Range Address	
	10			Carriage Return	
	11			Carriage Return	
	12			Line Feed	

	13			Line Feed
	14			Figure Shift
2	1	N		Indicates data type 1 = Nominal, 2 = Inflight, 3 = Powered flight, 4 = Simulated
	2	O	2	Indicates test number
	3	O	2	Indicates test number
	4	O	2	Indicates test number
	5	O	2	Indicates test number
	6	O	2	Indicates test number
	7			Single space
	8	M		Indicates month of year (tens)
	9	M		Indicates month of year (units)
	10			Single space
	11	D		Day of month (tens)
	12	D		Day of month (units)
	13			Single space
	14	P	3	Indicates rev number (thousands)
	15	P	3	Indicates rev number (hundreds)
	16	P	3	Indicates rev number (tens)
	17	P	3	Indicates rev number (units)
	18			Single space
	19	B	4	Indicates body number (units)
	20			Carriage return
	21			Carriage return
	22			Line feed

	23			Line feed
	24			Figure shift
3	1	S		Indicates sign of E data - = Negative & = Positive
	2	E	5	Most Significant Digit (MSD) of E parameter
	3	E		
	4	E		
	5	E		
	6	E		
	7	E		
	8	E		
	9	E		
	10	E		
	11	E		Least Significant Digit (LSD) of E parameter
	12			Single space
	13	C	6	Checksum for E parameter (tens)
	14	C	6	Checksum for E parameter (units)
	15			Single space
	16	S		Indicates sign of data - = Negative & = Positive
	17	F	5	MSD of F parameter
	18	F		
	19	F		
	20	F		
	21	F		

22	F		
23	F		
24	F		
25	F		
26	F		LSD of F parameter
27			Single space
28	C	6	Checksum for F parameter (tens)
29	C	6	Checksum for F parameter (units)
30			Single space
31	S		Indicates sign of G data - = Negative & = Positive
32	G	5	MSD of G parameter
33	G		
34	G		
35	G		
36	G		
37	G		
38	G		
39	G		
40	G		
41	G		LSD of G parameter
42			Single space
43	C	6	Checksum for G parameter (tens)
44	C	6	Checksum for G parameter (units)
45			Carriage return
46			Carriage return

	47			Line feed	
	48			Line feed	
	49			Figure shift	
4	1	S		Indicates sign of $\dot{E}$ data	- = Negative & = Positive
	2	$\dot{E}$	7	MSD of $\dot{E}$ parameter	
	3	$\dot{E}$			
	4	$\dot{E}$			
	5	$\dot{E}$			
	6	$\dot{E}$			
	7	$\dot{E}$			(tenths)
	8	$\dot{E}$		LSD of $\dot{E}$ parameter	(hundredths)
	9			Single space	
	10	C	6	Checksum for $\dot{E}$ parameter	(tens)
	11	C	6	Checksum for $\dot{E}$ parameter	(units)
	12			Single space	
	13	S		Indicates sign of $\dot{F}$ data	- = Negative & = Positive
	14	$\dot{F}$	7	MSD of $\dot{F}$ parameter	(velocity)
	15	$\dot{F}$			
	16	$\dot{F}$			
	17	$\dot{F}$			
	18	$\dot{F}$			
	19	$\dot{F}$			(tenths)
	20	$\dot{F}$		LSD of $\dot{F}$ parameter	(hundredths)

21			Single space	
22	C	6	Checksum for $\dot{F}$ parameter	(tens)
23	C	6	Checksum for $\dot{F}$ parameter	(units)
24			Single space	
25	S		Indicates sign $\dot{G}$ data	- = Negative & = Positive
26	$\dot{G}$	7	MSD of $\dot{G}$ parameter	(velocity)
27	$\dot{G}$			
28	$\dot{G}$			
29	$\dot{G}$			
30	$\dot{G}$			
31	$\dot{G}$			(tenths)
32	$\dot{G}$		LSD of $\dot{G}$ parameter	(hundredths)
33			Single space	
34	C		Checksum for $\dot{G}$ parameter	(tens)
35	C		Checksum for $\dot{G}$ parameter	(units)
36			Single space	
37	H	8	Tens of hours	
38	H		Units of hours	
39	M		Tens of minutes	
40	M		Units of minutes	
41	S		Tens of seconds	
42	S		Units of seconds	
43	S		Tenths of a second	
44			Single space	
45	C	5	Checksum for time word	(tens)
46	C	5	Checksum for time word	(units)

	47		Carriage return
	48		Carriage return
	49		Line feed
	50		Line feed
	51		Letter shift
5	1	I	Always same
	2	R	Always same
	3	E	Always same
	4	D	Always same
	5	T	Always same
	6	R	Always same
	7	M	Always same
	8	E	Always same
	9		Carriage return
	10		Carriage return
	11		Line feed
	12		Line feed
	13		Figure shift

NOTE 1: Range Address

a. To address a message to one of the following Range agencies, insert the appropriate letter code in character number 5:

E AD, Eglin, AFB, FL

M PMTC, Pt. Mugu, CA

W WSMR, NM

A WSMC, Vandenberg AFB, CA

P ESMC, Patrick AFB, FL

B AFSCF, Sunnyvale, CA

G GSFC, Greenbelt, MD

H JSC, Houston, TX

K Kwajalein Missile Range

D All DOD ranges

C All DOD and NASA ranges

S Range Instrumentation Ships

b. For multiple address, insert appropriate code letters in characters 5 through 9. Sequence of letters is not important.

c. Examples: (* indicates teletype spaces)

(1) W**** - To WMSR

(2) PWK** - To ESMC, WSMR, and KMR

(3) GDS** - To GSFC, all DOD ranges, all ships

(4) CS*** - To all DOD and NASA range agencies, and to all ships

(5) PAWEM - To ESMC, WSMC, WSMR, AD, and PMTC

NOTE 2: A four digit operation number would be placed in characters 3 through 6, three digit operation number in characters 4 through 6 (operation number is always placed to the right). Shuttle program will show 4 digit SIC number in place of test number.

NOTE 3: Rev is defined as a complete cycle around the Earth, starting and ending with the ascending node; number 0 begins at launch.

NOTE 4: These characters will generally be zero for programs consisting of a single orbiting body. Shuttle program shows VID here.

NOTE 5: Indicate Earth centered position in meters with the decimal implied after characters 11, 26, and 41. The coordinate system is non-inertial, right-hand cartesian with the positive E-axis extending from the geocenter through the prime meridian at the equator, the positive F-axis extending from the geocenter through the 90°E meridian at the equator, and the positive G-axis extending from the geocenter through the North Pole.

NOTE 6: Decimal addition of characters in parameters indicated; add 1 to checksum if sign of parameter is negative, i.e., -1234567890 = 46 where 46 is the checksum.

NOTE 7: Indicate earth fixed velocity in meters, non-inertial. The decimal is implied between characters 6 and 7, 18 and 19, and 30 and 31.

NOTE 8: This is the time of the point indicated by the vector and is in Zulu time. A decimal is implied between characters 42 and 43.

GENERAL NOTE: Zeroes will be inserted in all data characters not used or needed. SPACES ARE BLANK.

ACQUISITION EARTH MODEL

The IRIG WGS-72 Convention will be used as a reference spheroid for generating acquisition data. Constants for this spheroid are:

1. Coefficient of flattening [F]: 1:298.26

2. Equatorial radius [a]: 6,378,135 meters
   also: 20,925,639 international feet

3. Eccentricity squared $[e^2 = F(2-F)]$: $.6694317778 \times 10^{-2}$

4. Polar radius [b = a(1-F)]: 6356750.52 meters

5. Conversion factor: 1 foot = 0.3048 meters

SUPPLEMENTARY

INFORMATION

Revised June 1989

ADDENDUM
Document 152-83
IRIG Standard for Distributing Interrange
Vector Acquisition Data

1. Replace para 1, page 1 under STANDARD REFERENCES AND PROCEDURES as follows:

"1. The IRIG WGS 84 Convention, described in a subsequent paragraph, is used as the reference spheriod for acquisition data."

2. On page 11, replace the ACQUISITION EARTH MODEL description as follows:

"The IRIG WGS 84 convention will be used as a reference spheroid for generating acquisition data. Constants for this spheroid are:

1. Coefficient of flattening [f]: 1/298.257223563

2. Semi-major Axis [a]: 6378137m
   also: 20,925,646.33 International feet

3. Eccentricity squared [e = f(2-f)]: 0.00669437999013

4. Semi-minor Axis [b = a(1-f)]: 6356752.3142 meters

5. Conversion factor: 1 International foot = 0.3048 meters
   (1 US Survey foot = 12/39.37 meters)"